

PRELIMINARY AMENDMENT
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greater than 1:0.4, preferably greater than or equal to 1:0.2, to a temperature of at least about 1000°C whereby to effect incomplete combustion and pyrolytic decomposition of said hydrocarbon fuel.

Claim 16. The method as claimed in Claim 15, wherein the value of x in the x:y ratio exceeds 40.

982 Claim 17. The method as claimed in Claim 15, comprising at least the steps of pre-heating the bulk feedstock fuel and passing said bulk feedstock fuel into a reactor in which said bulk feedstock fuel is rapidly heated to a temperature of between about 1000 and 2000°C for between 0.1 and 10 seconds by interspersing said bulk feedstock fuel with air- or oxygen-assisted hydrocarbon flames utilizing said flame fuel, to obtain localized heating whereby to effect partial pyrolytic decomposition.

Claim 18. The method as claimed in Claim 17, wherein said hydrocarbon flames are oxygen-assisted.

Claim 19. The method as claimed in Claim 15, wherein said bulk stock fuel and flame fuel are the same or different, and said temperature of 1000°C is achieved by combustion of the flame fuel which is mixed with, or separate to, the bulk feedstock fuel.

Claim 20. The method as claimed in Claim 19, wherein said bulk feedstock fuel and flame fuel are the same or different and are mixed together, and said temperature of 1000°C is achieved by ignition of the hydrocarbon fuel causing localized combustion of the flame fuel within said bulk feedstock fuel.

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Claim 21. The method as claimed in Claim 15, wherein the combustion products are interspersed with the feedstock fuel by the use of turbulence.

Claim 22. The method as claimed in Claim 21, wherein turbulence is achieved by introducing one or more of the flame, combustion products, flame gas, oxidizer, hydrocarbon fuel or feedstock fuel into the reactor at a velocity of 20-200m/s.

92 Claim 23. The method as claimed in Claim 15, wherein the feedstock fuel is comprised of one or more gaseous hydrocarbons.

Claim 24. The method as claimed in Claim 15, wherein the feedstock fuel is natural gas.

Claim 25. The solid carbonaceous product obtainable by the method described in Claim 15.

Claim 26. The method of producing a hydrogen-rich gas with a H:C stoichiometric ratio equal to or exceeding 20:1, and a H:O stoichiometric ratio greater or equal to 5:1, wherein a hydrocarbon fuel is heated with oxygen at a C:O stoichiometric ratio greater than 1:1, preferably greater than or equal to 1:0.2, to a temperature of at least about 1000°C whereby to effect partial pyrolytic decomposition of said hydrocarbon fuel according to the method as defined in Claim 15.

Claim 27. The method of combustion, wherein the hydrogen-rich gas produced according to the method of Claim 26 is combusted.

Claim 28. The reactor for performing the method described in Claim 15 comprising at least:

one or more inlet ports allowing entry of the hydrocarbon fuel into the reactor cavity, one or more outlet